


Projection of U.S. Coal-Fired Power Plants Potentially Impacted by Excess SO₃ Emissions



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DOE/NETL Innovations for Existing Plants R&D Program

- **R&D Activities**

- Mercury control
- Coal utilization by-products
- Water management
- NO_x control
- Particulate matter control
- Air quality research



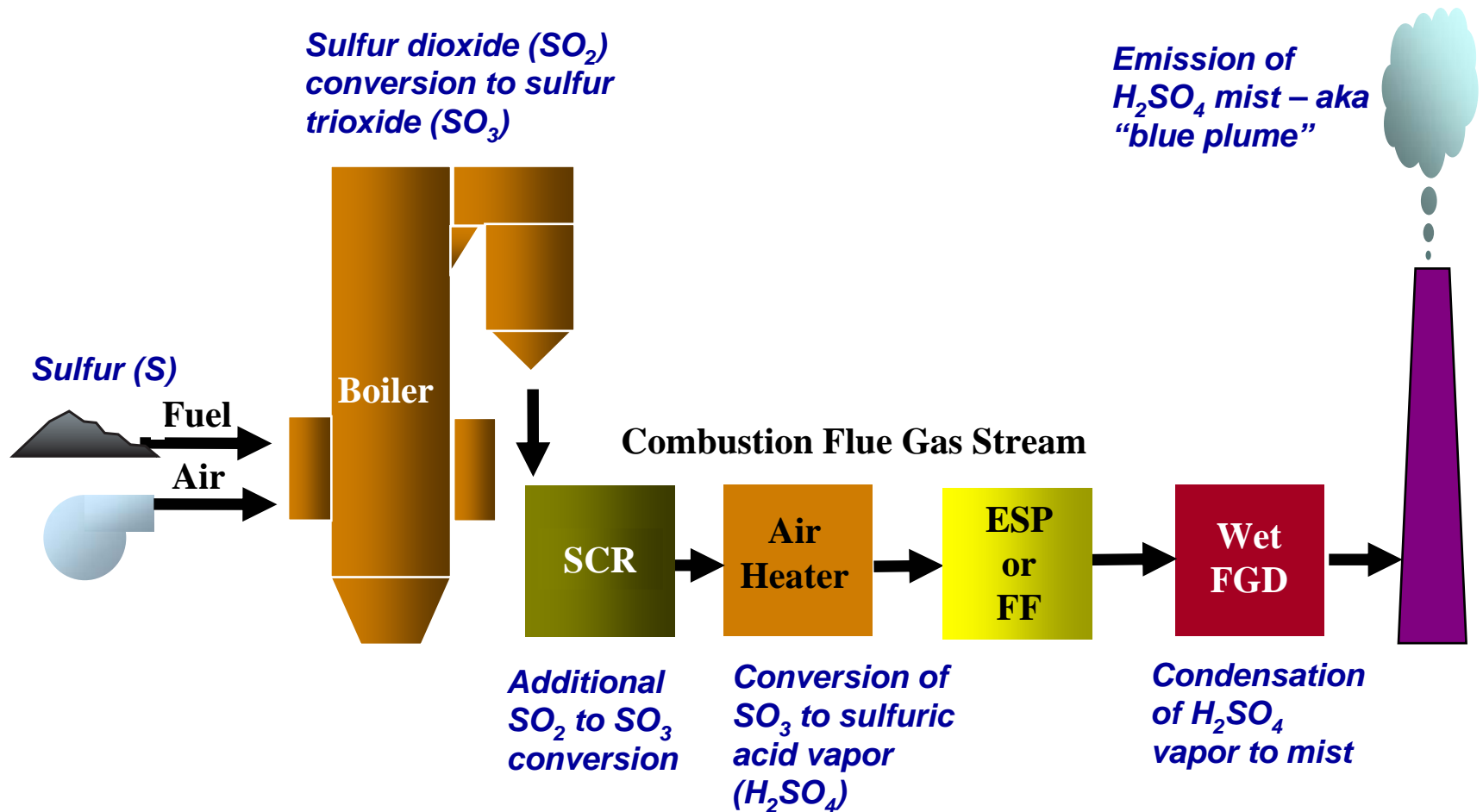
Stack SO₃ Emissions



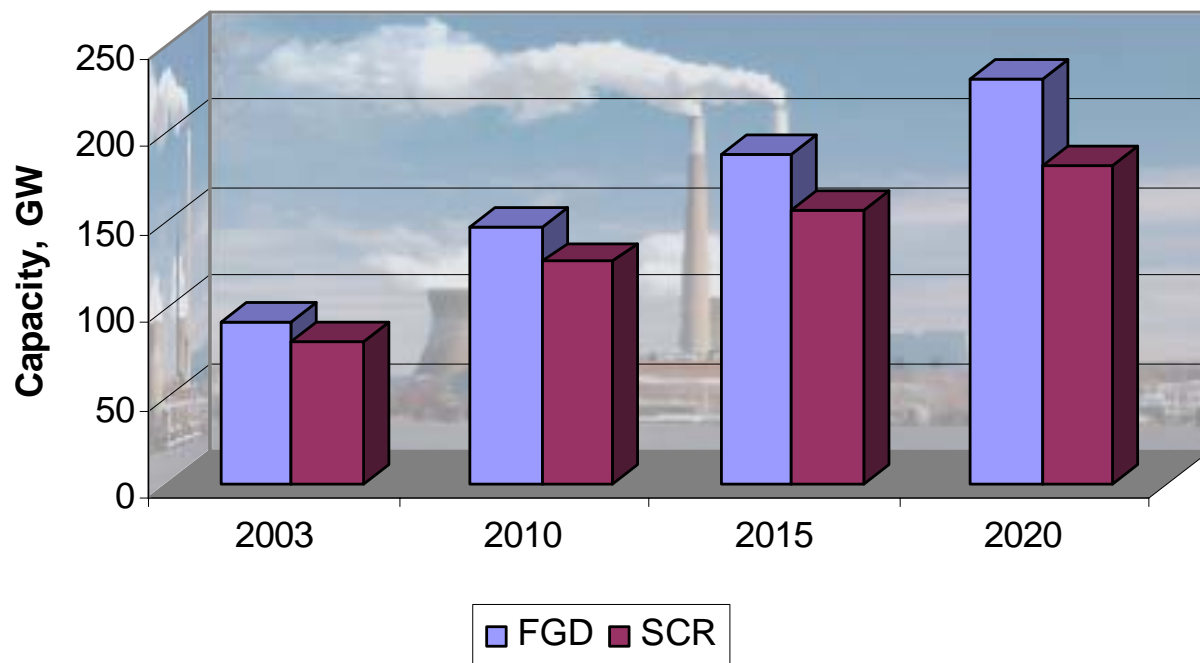
Photo courtesy of URS Corp.

- **What's the problem?**
 - Opacity violation due to blue plume caused by sulfuric acid mist
 - Plants equipped with wet FGD system
- **How much is too much?**
 - SO₃ not regulated
 - 56,000 tons of sulfuric acid emissions in 2004 per EPA's TRI
 - Limit SO₃ to 5-10 ppm to avoid excess opacity?

Formation of $\text{SO}_3/\text{H}_2\text{SO}_4$ Emissions from a Coal-Fired Power Plant

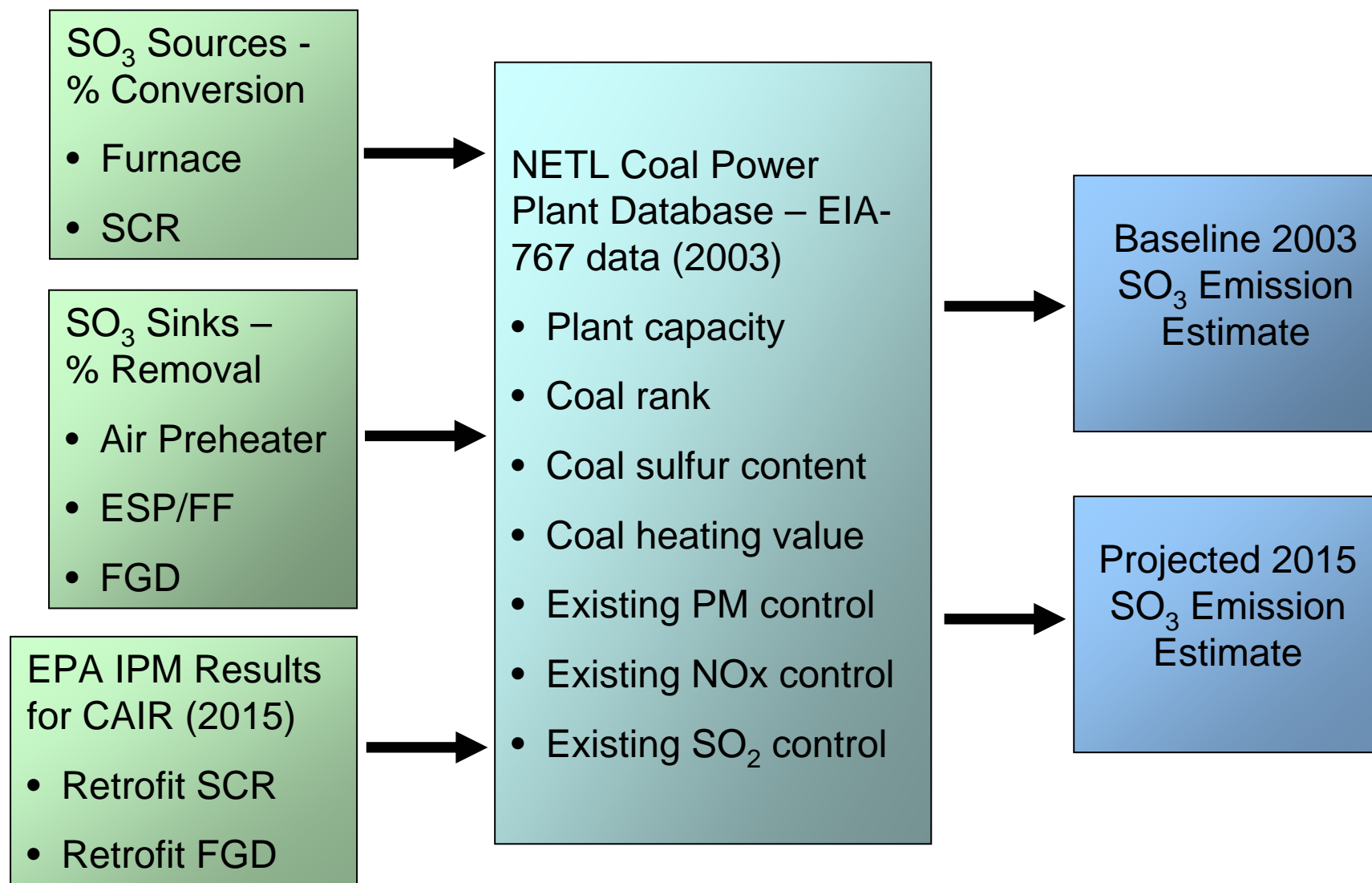


EPA's Clean Air Interstate Rule (CAIR) Projections of FGD & SCR Capacity



- FGD increases from 92 GW in 2003 to 188 GW in 2015
- SCR increases from 81 GW in 2003 to 156 GW in 2015

Analysis Approach

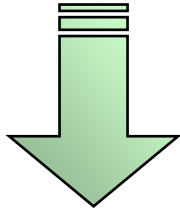


Assumptions for Sources and Sinks of $\text{SO}_3/\text{H}_2\text{SO}_4$

Bituminous Coal-Fired Plants

Sources

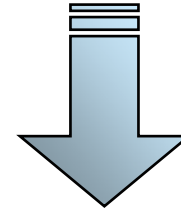
- Furnace conversion of SO_2 to SO_3 @ 1%
- SCR catalyst conversion of SO_2 to SO_3 @ 1%



**1% sulfur coal would
produce ~ 12 ppm SO_3**

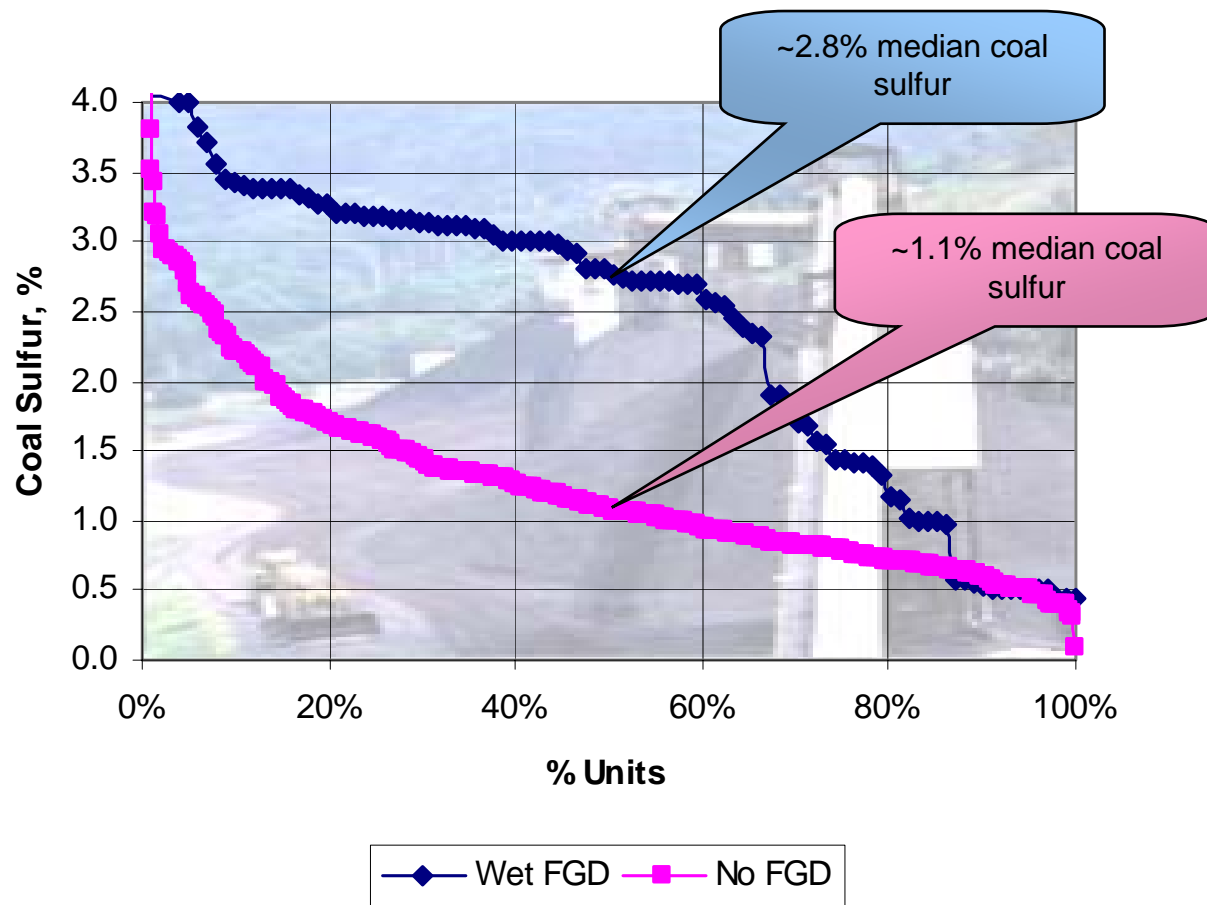
Sinks

- Condensation in air preheater @ 20%
- Adsorption on fly ash and capture by ESP @ 15%
- Capture by wet FGD @ 15%



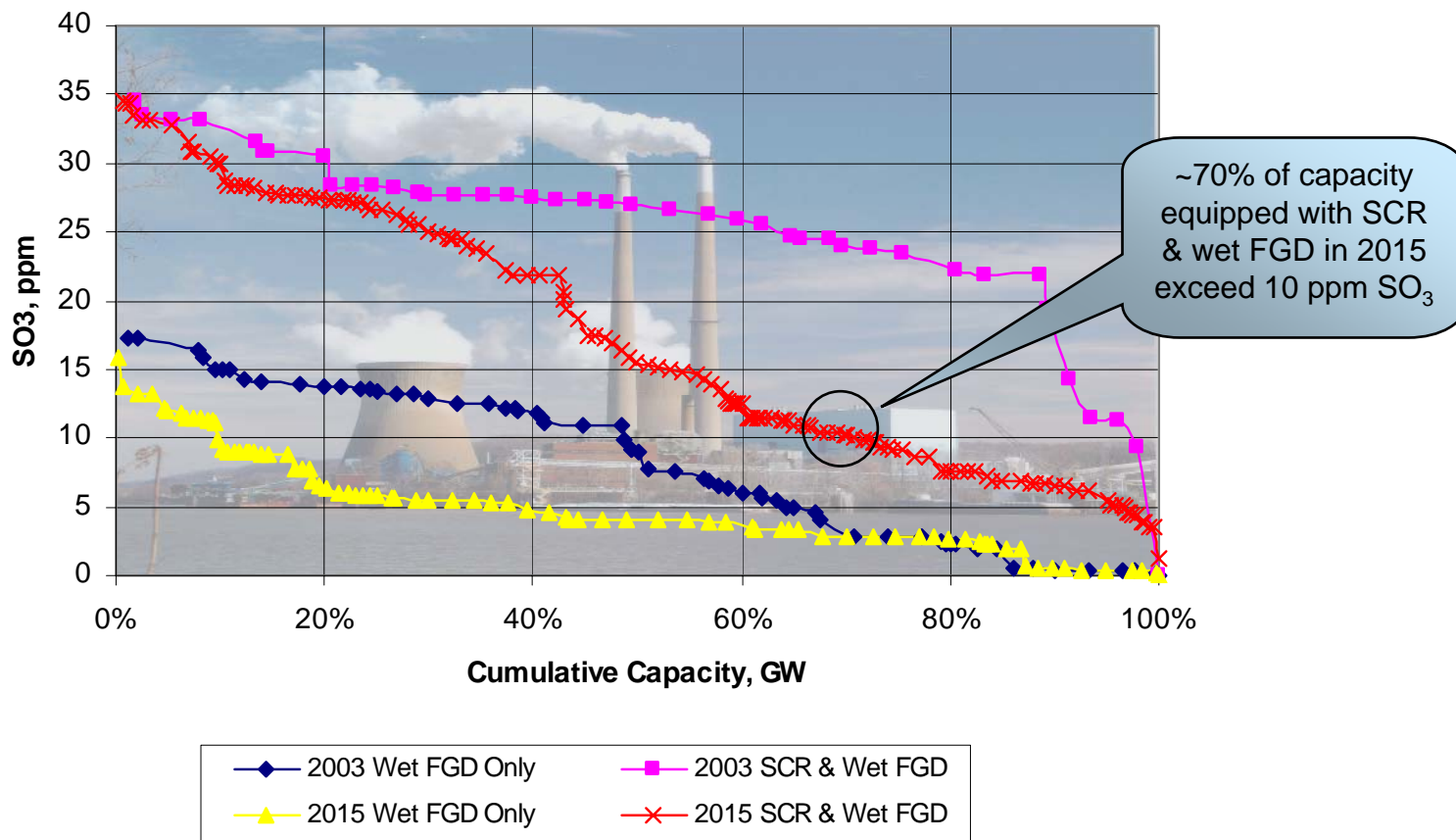
~ 42% Capture

Bituminous Coal Sulfur Content Distribution for Existing Plants with and without Wet FGD



Estimated SO₃ Emissions for Plants Equipped with Wet FGD Only or SCR & Wet FGD

Stack SO₃ Emissions for Bituminous Coal-Fired Units



Projected % MW Capacity with SO₃ Emissions That Exceeds 5 or 10 ppm

Bituminous Coal	2003		
	Total Wet FGD	Wet FGD Only	SCR + Wet FGD
No. Units	103	62	41
Capacity, MW	49,173	24,659	24,514
% MW > 5 ppm SO ₃	81%	63%	98%
% MW > 10 ppm SO ₃	72%	49%	96%

2003

- 63% of 25 GW capacity equipped w/ wet FGD only projected to exceed 5 ppm SO₃ emission rate
- 98% of 25 GW capacity equipped w/ SCR & wet FGD projected to exceed 5 ppm SO₃ emission rate

2015

- 38% of 33 GW capacity equipped w/ wet FGD only projected to exceed 5 ppm SO₃ emission rate
- 96% of 75 GW capacity equipped w/ SCR & wet FGD projected to exceed 5 ppm SO₃ emission rate

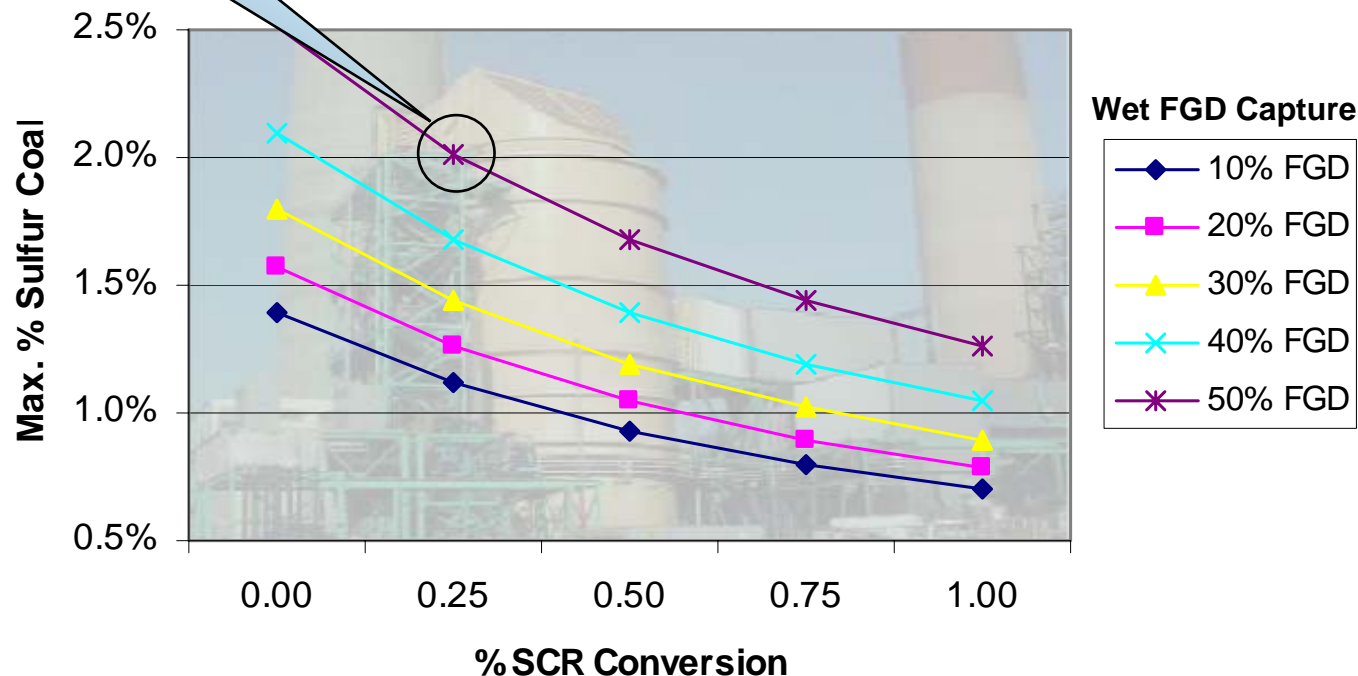
Bituminous Coal	2015		
	Total Wet FGD	Wet FGD Only	SCR + Wet FGD
No. Units	227	84	143
Capacity, MW	108,348	33,327	75,021
% MW > 5 ppm SO ₃	78%	38%	96%
% MW > 10 ppm SO ₃	52%	9%	70%



Maximum Coal Sulfur Content vs. SCR Conversion & FGD Capture

Max. 2 % S coal @
0.25 % SCR
conversion and
50% FGD capture

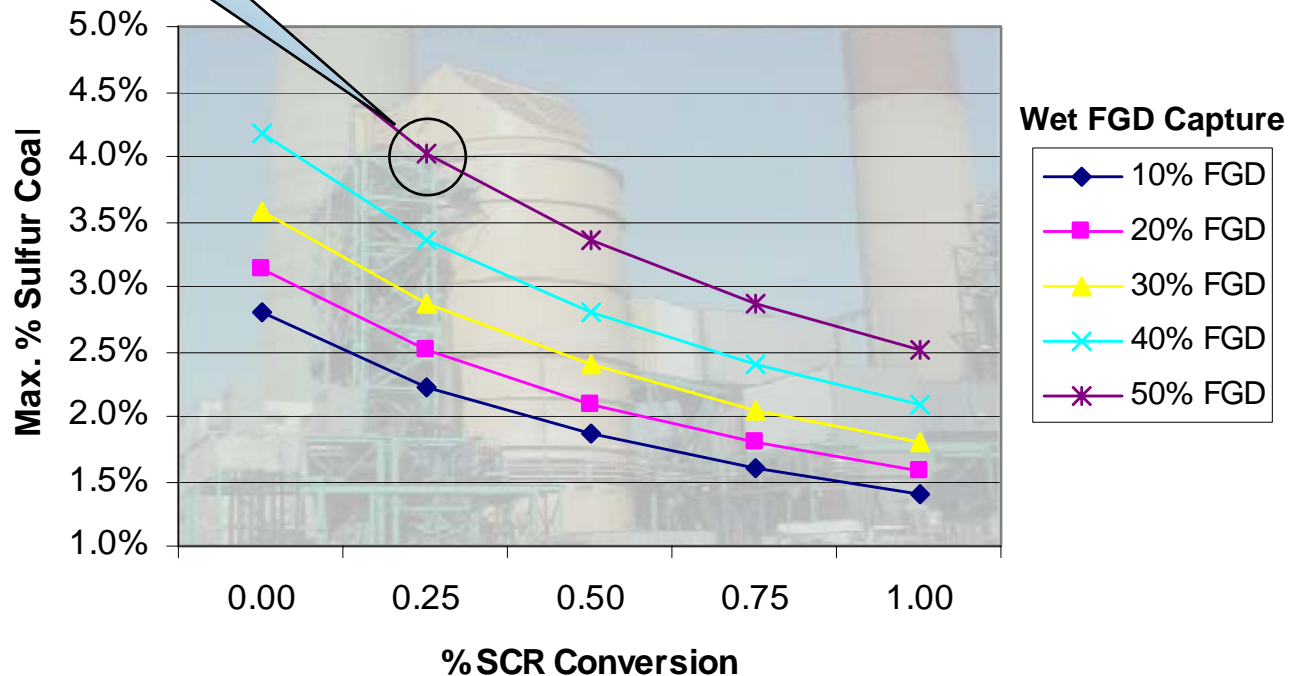
Stack SO_3 @ 5 ppm



Maximum Coal Sulfur Content vs. SCR Conversion & FGD Capture

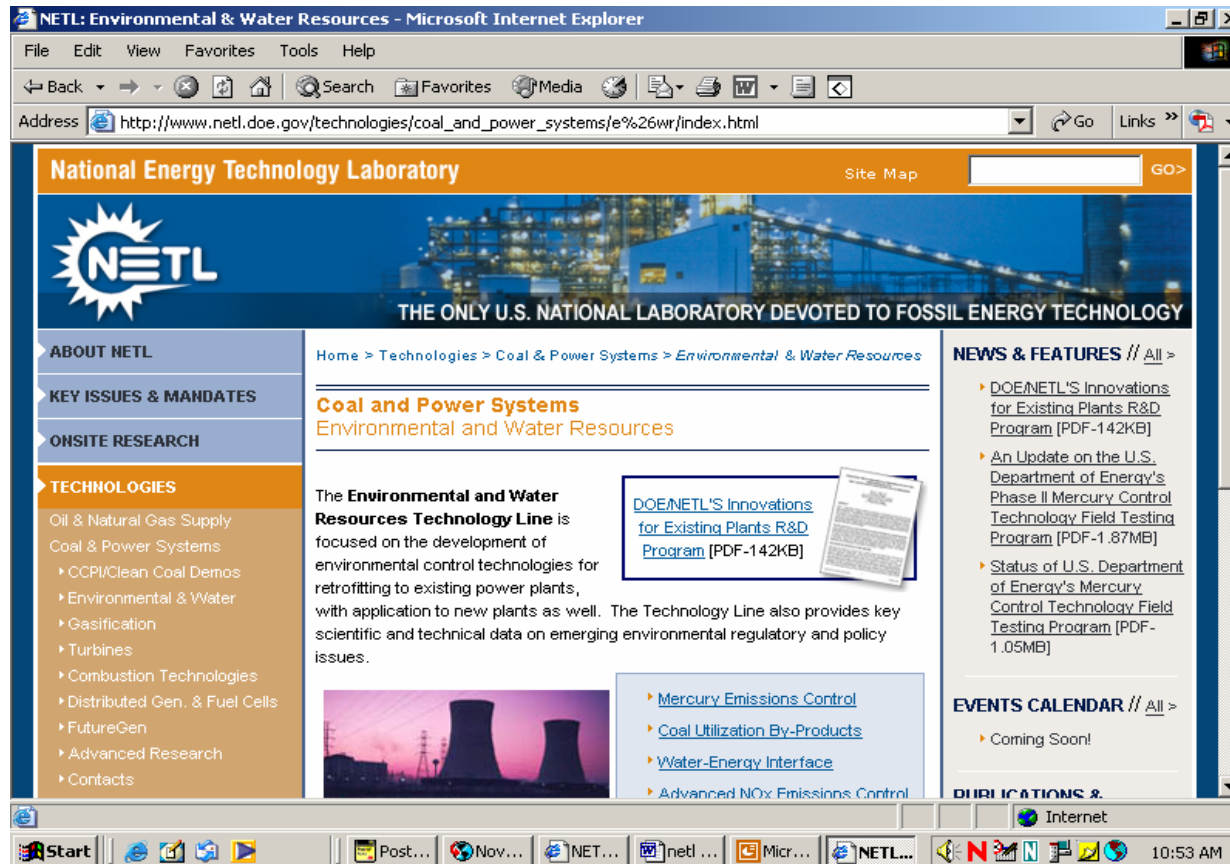
Max. 4 % S coal @
0.25 % SCR
conversion and
50% FGD capture

Stack SO_3 @ 10 ppm



DOE/NETL

Innovations for Existing Plants Program



To find out more about DOE-NETL's IEP R&D activities visit us at:
<http://www.netl.doe.gov/technologies/coalpower/ewr/index.html>



Questions?

